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REPORT AND PRELIMINARY RESULTS OF
POSEIDON CRUISE 320
LAS PALMAS (SPAIN) - LAS PALMAS (SPAIN)
March 08th - March 18th, 2005

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1. Participants R/V Poseidon Cruise 320

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ASU Arizona State University, Tempe, AZ 85287-4501, USA

2. Research Objectives

The upwelling area off NW-Africa is one of the most important upwelling systems of the global ocean influenced by high amounts of Sahara dust which is transporting nutrients into the ocean. Both factors are of fundamental importance for the particle production in the ocean influencing the processes of the biological carbon pump system. Hence, they are controlling factors of the global atmospheric CO₂-budget. Despite the main driving force for climatic variability located in the North-Atlantic, the upwelling area off NW-Africa is suitable to reconstruct the past climatic variability, via observation of present in-situ environmental datasets.

The research topics were carried out in correlation with the following project:

2.1 MERSEA (Marine EnviRonment and Security for the European Area – Integrated Project)

The main task will concentrate on the MERSEA EU project, which is closely linked to the ANIMATE EU project, finished in November 2004, and the DOLAN EU project, closed down in April 2004. The main aim of MERSEA will be the management of data, and their conditioning for scientific end-users.

The participating institutions during R/V POSEIDON cruise 320, MARUM/University of Bremen, ICCM and SOC, are involved in work package 3. They will ensure the availability of real time and delayed-mode and regional in-situ data and products in the form required by the MERSEA modelling, data assimilation and validation systems. The activities are partly research and development, innovation, and partly demonstration. The served research sites, continued from ANIMATE and DOLAN, are DOLAN/ESTOC, Canary Islands; PAP, Porcupine Abyssal Plain; CIS, Central Irminger Sea. The main task during POS 320 cruise will be the work on the DOLAN site. The DOLAN station is located 25 nm west of ESTOC and comprises technical devices for transmission of scientific data sets via satellite into the internet and research institutes.

3. Narrative of the Cruise

R/V Poseidon left the port of Las Palmas on March 8th with heading to DOLAN position. The scientific work started with a CTD cast down to 500 m water depth, as preparation for the planned exposure of the drifter traps. Afterwards, another CTD cast, near the DOLAN position, down to 500 m water was run, needed for the post calibration of the DOLAN sensors.

March 9th began with the deployment of drifter traps, followed by a CTD cast, down to 500 m water depth. At 11:00 R/V POSEIDON reached the DOLAN position. The rest of the day was used to recover the complete DOLAN mooring array. Then R/V POSEIDON steamed onto the MSD position. During the morning of the next day the MSD-4 mooring had been recovered. The time until the redeployment was used for the recovery of the exposed drifter traps above. The MSD-5 mooring array was successfully redeployed until the early evening.

During the night a rosette cast was planned down to 3600 m water depth, located near the ESTOC position, which should be run for the routine monthly water sampling. Due to serious problems with the hydraulics system, responsible for the winches, the cast was canceled. At 08:00 pm on March 11th R/V POSEIDON reached the ESTOC position. The scientific work started with the successful recovery of the CI-17 mooring, which could be finished at noon. During the afternoon the ESTOC rosette cast down to 3600 m water depth had been done. To get reference samples, belonging to the recovered drifter traps, another rosette cast down to 1500 m water depth was carried out. Afterwards R/V POSEIDON went on the transect between Tenerife and Gomera down to El Hierro.

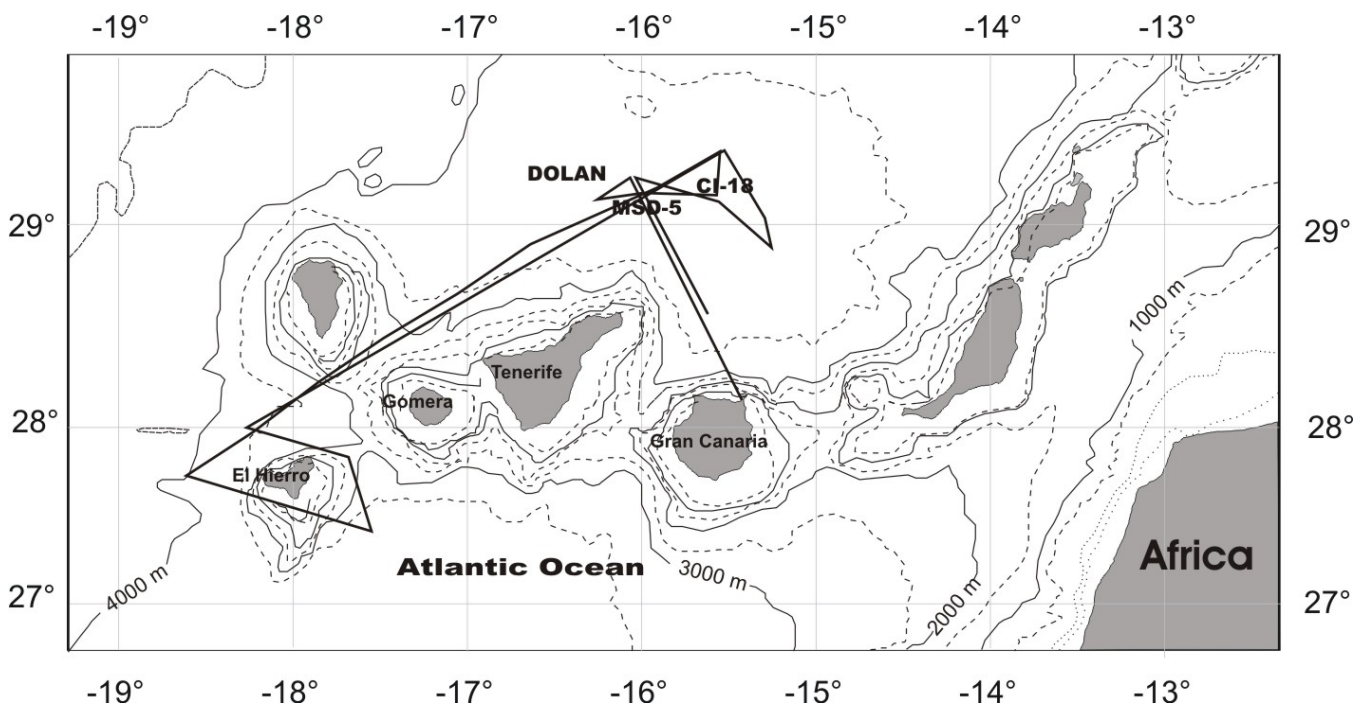


Figure 1: Cruise track R/V POSEIDON cruise 320.

During the next two days nine rosette casts were lowered on this transect. On March 15th R/V POSEIDON reached again the ESTOC position. The CI-18 mooring was redeployed during the morning without any problems. The scientific work was continued with a rosette cast down to 500 m water depth, as preparation for the following second deployment of the drifter traps. Thereafter a calibration cast down to 500 m water depth was lowered for the sensors, which were prepared for the use in the DOLAN mooring. That included the six MicroCats and the HS2 fluorometer. The night was used to conduct three rosette casts around the ESTOC station. Then R/V POSEIDON left the ESTOC CI-18 position with heading to the DOLAN location.

The next day the deployment of the first part of the DOLAN mooring followed. That contained the lower 3000 m and the dummy buoyancy. In the course of the following day the dummy buoyancy pack was exchanged against the DOLAN surface bouy (SBU). During the afternoon the drifter traps were recovered and the last task for this cruise was the accompanying CTD cast.

At 18:30 am on March 17th the scientific work had been finished and R/V POSEIDON steamed back to Las Palmas harbour. All station work could be completed as planned.

4. Scientific Report

4.1 Equipment Development and Tests

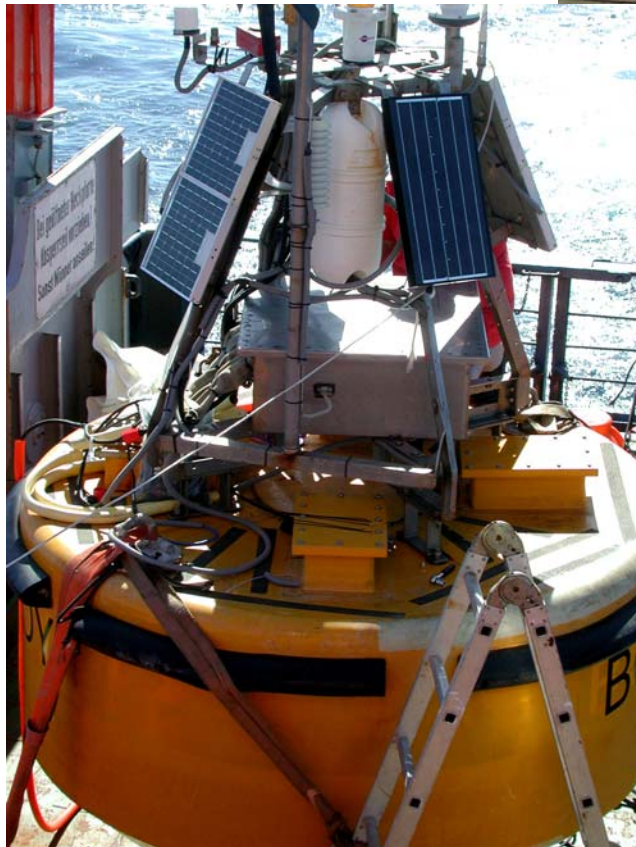
4.1.1 DOLAN Surface Buoy (SBU)

The Surface Buoy Unit (SBU) operates since 1997 and was formerly part of the DOMEST project. The unit serves for the development of satellite based telemetry technologies.

On March 10th the DOLAN mooring array, which is located at 29°10,40'N and 15°55,30'W at a water depth of 3630 m, was recovered. The last routine maintenance has been carried out during R/V POSEIDON cruise 319 in December 2004.



Figure 2: Recovery of the SBU.



During R/V POSEIDON cruise 320 the DOLAN mooring array was completely recovered for maintenance, as well as integration of additional components into the SBU telemetry. Additionally the attached sensors were maintained or exchanged, which includes the SAMI sensor, 6 MicroCats, an acoustic transducer, one nutrient analyser and HS2 fluorometer.

Figure 3: Recovered SBU.



Figure 4: Recovered SAMI CO₂ sensor.

The fluorometer and the nutrient analyser in 100 m water depth were only very slightly affected by biofouling. The copper shutter of the fluorometer worked well, so that it's optical system has been found without a biofouling film. The intake of the nutrient analyser was not effected by biofouling as well.

Figure 5: Recovered frame with HS2 flourometer and nutrient sensor.



The six MicroCats which had been moored between 10 m and 100 m water depth were recovered without biofouling. One MicroCat which has been flooded was recovered without its conductivity cell. No problems with this MicroCat occurred during the deployment. We suppose that it was damaged by a long line of the tuna fishery.

Status of DOLAN before maintenance

The INMARSAT tracking system installed in December worked perfectly. It transferred one position report every day.

The recovered sensors at 10 m water depth, including the SAMI CO₂ sensor and one MicroCat, were completely covered with mussels. Due to this fouling the measured volume had no exchange with the surrounding water, which could explain the very low CO₂ readings received by the sensor. The telemetry of the SAMI sensor and of the MicroCat in 10 m water depth worked very well during this mooring period.

The maintenance of the buoy electronics shows that the buoy was in a good shape. Both, 12V and 24V power supply were working well. The 12V data logger shows a constant voltage until the 13.02.05. From this time on the voltage was decreasing. The maintenance of the 12V solar system showed corrosion in the solar junction box. This has been repaired.

DOLAN 12V Power supply

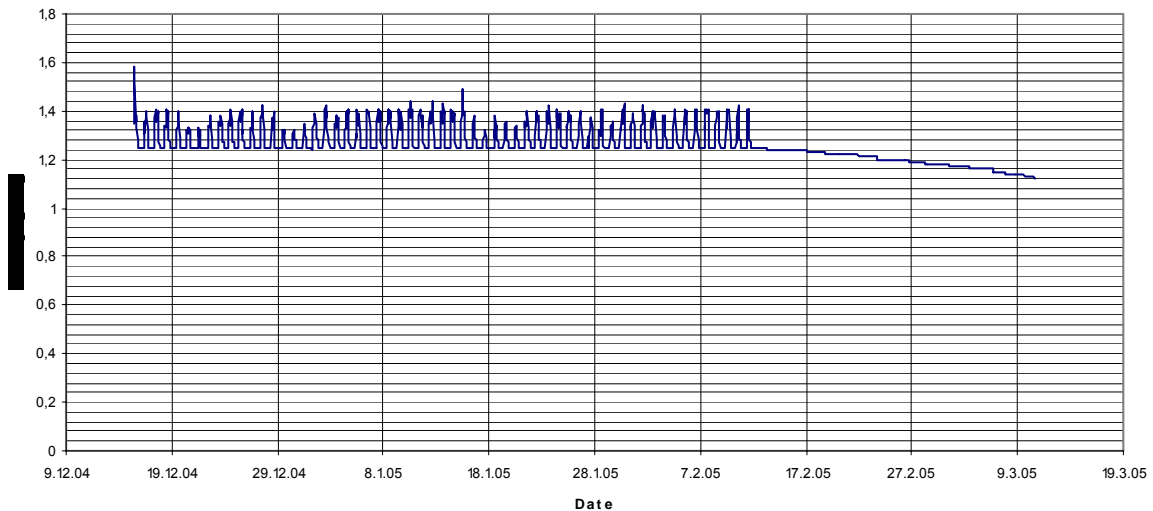


Figure 6: Plot of the 12V power supply during the deployment period.

The voltage of the 24V power supply is shown below. No problems have been detected in the 24V power supply.

DOLAN 24V Power supply

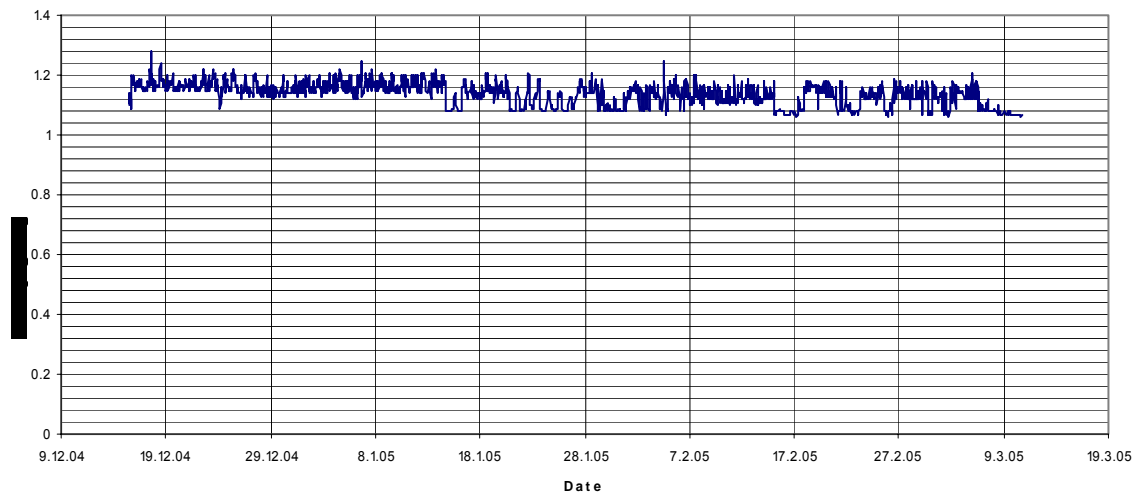


Figure 7: Plot of the 24V power supply during the deployment period.

Due to problems with the power switch board during the last mooring period this board was replaced. The new board was tested during three days on deck of the vessel. No problems occurred during this time. Several messages have been automatically generated and sent via the Iridium and the Orbcomm satellite link. The acoustic wind speed sensor has been reinstalled after the maintenance in Bremen. The averaging routines and the calculation of the true wind directing involving the compass data has been ported from the ANIMATE II

telemetry to the DOLIX computer. The wind speed and wind direction data have been compared with the ship wind data. The results were reasonable but due to the fact that the buoy was standing on the aft deck the readings were not exact the same as the ships wind data.

One problem occurred during the deployment of the DOLAN buoy. The system was working well until the deployment, the messages have been sent via Iridium and Orbcomm. No more Iridium messages have been received after the deployment on this cruise. Several approaches to connect the DOLIX computer were unsuccessful. The meteorological and MicroCat data sent via the Orbcomm link have been received correctly. The only sensor which is currently not working is the acoustic wind sensor.

Overview on the installed sensors / telemetry since December 2004

Sensor	Telemetry	Status
Vaisala PTU200 - air temperature - relative humidity - barometric pressure	ORBCOMM	ONLINE
Vaisala WS245 - windspeed - winddirection	IRIDIUM	OFFLINE
TCM2 - buoy heading - pitch and roll for the buoy	Not in telemetrie	
Thrane & Thrane - GPS	INMARSAT	ONLINE
Microcat @10m	ORBCOMM	ONLINE
Fluorometer HS2	Not in telemetry	
Nutrient Analyser NAS-3X	Not in telemetry	
DOLIX GPS	IRIDIUM	OFFLINE

Tasks for the next cruise

- implementation of a more stable power switch concept
- implementation of an log concept for different units to determine the propagation of failures
- development of an robust sub-sea cable link for the fluorometer and nutrient analyser in 100m depth
- monitoring of the power supply voltages (12V and 24V) via the DOLIX or the power switch board

Configuration of the DOLAN buoy after POS320

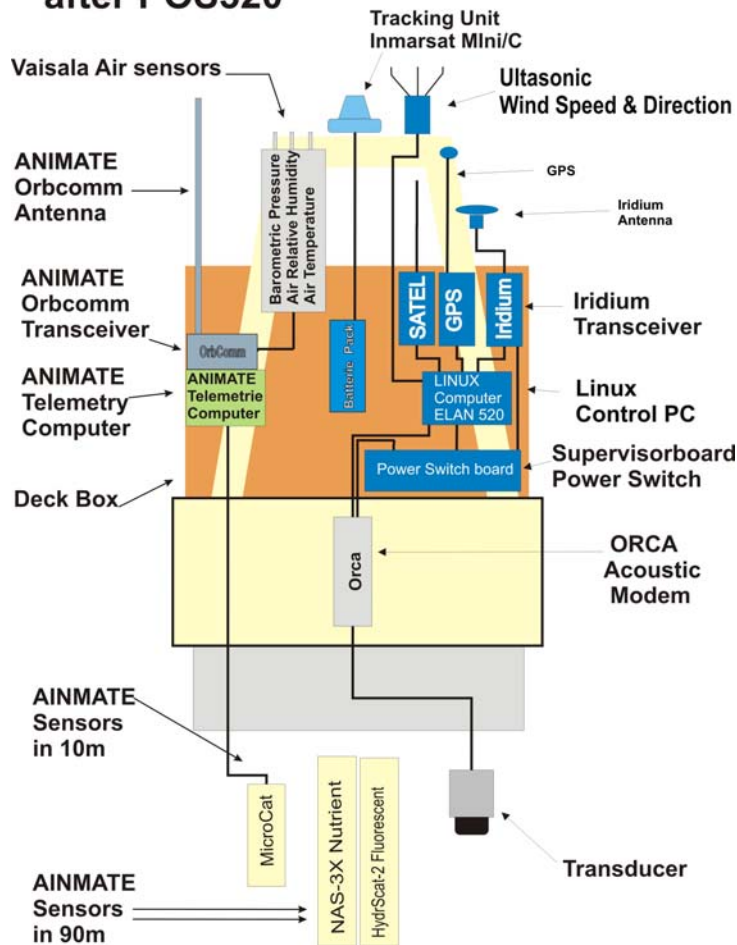


Figure 8: Configuration of the DOLAN SBU after POS cruise 320.

DOLAN configuration March 2005

The sensors which have been maintained in Bremen were mounted on the DOLAN buoy again. The Vaisala wind sensors are online via Orbcomm on the ANIMATE telemetry computer. The Vaisala wind sensor has been ported to the DOLIX computer, because the three dimensional vector calculation for true wind speed / direction were too complex for the ANIMATE telemetry computer. The second ANIMATE telemetry computer has been deactivated, but is still there as a spare unit. During the maintenance occurred some problems with SATEL modem. The handshake lines are not working properly for the transmission of bigger files from the DOLIX computer.

The DOLAN mooring was redeployed in two steps. On March 16th the mooring array was set with the changed configuration and a dummy buoyancy. During the last deployment phase the housing of one MicroCat was broken. It was impossible to repair this on board. It was decided to cancel the 20 m water depth position. During the current deployment there will be no SAMI CO₂ sensor in the mooring, due to the fact, that no new one is available for this time period. Also the ADCP is removed due to a damaged battery pack.

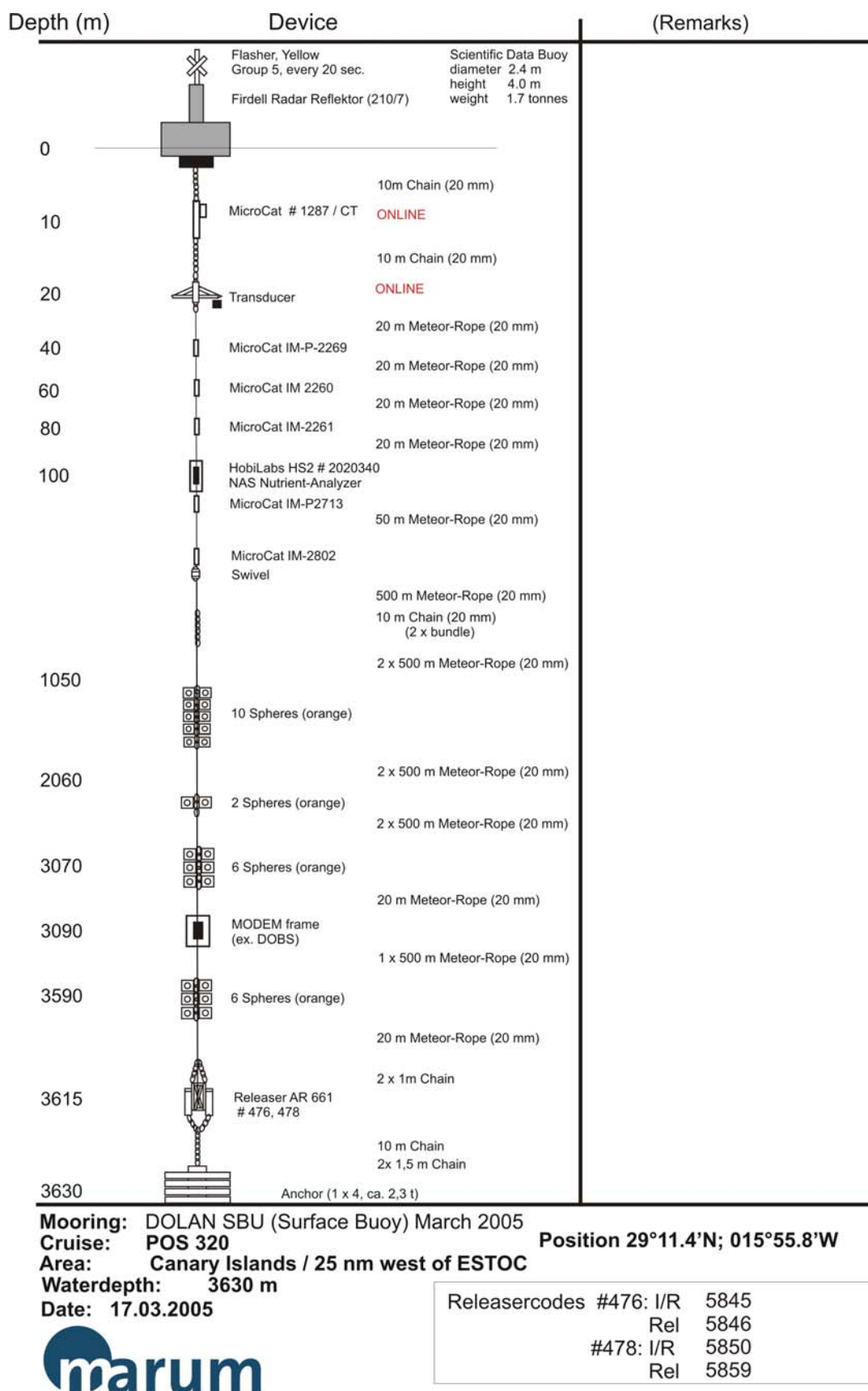


Figure 9: Drawing of the DOLAN-SBU.

4.2 Particle Collection with Sediment Traps

The particulate material collected will be analysed to determine total flux, particulate flux, particulate organic carbon, particulate nitrogen, biogenic opal, carbonate and stable isotopes of organic matter, and lithogenic material. The trapped material also will be investigated for species composition of the planktonic organisms (pteropods, foraminifera, coccolithophorides and diatoms). The objective of these studies is to identify signals of seasonal variations in those components, which play an important role in the sediment formation process. The result of these investigations will form a basis for the reconstruction of paleocurrent systems and paleoproduction from the sediments.

4.2.1 MSD-5 (DOLAN)

The MSD-4 mooring was deployed on December 13th at 29°12,12'N 12°50,12'W in a water depth of 3626 m. On March 10th this array, including the MSD sediment trap, which is equipped with two sample turntables, was recovered. The trap delivered a set of twelve samples, due to the fact, that the next routine maintenance was planned actually for autumn 2005. With regard to the scientific question of this research site, dealing with particle fluxes, the sediment trap depth was changed from 3000 m up to now 900 m water depth in the new mooring. This depth was chosen with respect to the compatibility between MSD and ESTOC site. The array was redeployed as MSD-5 on the same day.

4.2.2 CI-18 (ESTOC)

The CI-17 mooring array was deployed on April 25th 2004 at 29°04,10'N and 015°15,20'W at a water depth of 3589 m. It was recovered on March 11th. Attached to this array were three particle traps at water depths of 698 m, 1025 m and 3055 m. All traps delivered the whole sets of 20 samples.

The mooring was redeployed on March 15th as CI-18, with a comparable configuration. It is planned to recover this array in January 2006 with R/V MERIAN or R/V POSEIDON.

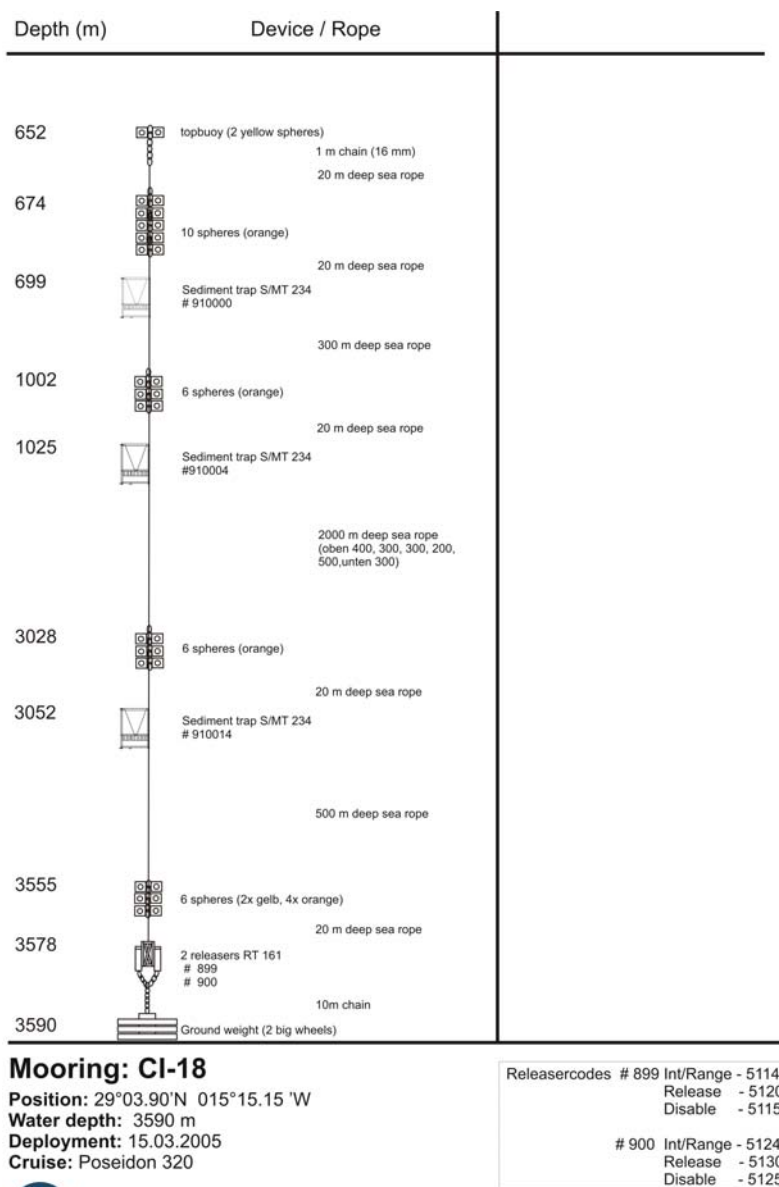


Figure 10: Drawing of CI-18 mooring.

Table 1: Mooring data for recoveries and redeployments during R/V POSEIDON cruise 320.

Mooring	Position	Water depth (m)	Interval	Instr. (m)	Depth	Intervals (no x days)
<u>Mooring recoveries</u>						
DOLAN MSD 4	29°12,12'N 15°50,12'W	3626	16.12.2004 11.10.2005	MSD	3050	41 x 7,5
ESTOC CI-17	29°04,25'N 15°15,08'W	3600	26.04.04 19.02.05	SMT 234 SMT 230	698 1025 3055	20 x 15
<u>Mooring deployments</u>						
DOLAN MSD 5	29°012,80'N 15°50,60'W	3630	11.03.2005 06.11.2005	MSD	890	41 x 6
ESTOC CI-18	29°03,90'N 15°15'15W	3590	16.03.05 10.01.06	SMT 234	699 1025 3052	20 x 15
Instruments used:						
MSD		= Particle sediment trap KUM, Kiel				
SMT 243		= Titan particle sediment trap SMT 243 KUM, Kiel				
SMT 230		= Particle sediment trap SMT 243 KUM, Kiel				

4.3 Marine Chemistry

During POSEIDON cruise 320 the ICCM had to exchange the nitrate sensor and extract the data. A new sensor was integrated, because the one on place did not work adequately.

At the same time it was necessary to do the biogeochemical monthly samplings at the ESTOC station (European Station for Time series in the Ocean Canary Islands) and surrounded areas, what has been continuously done since 1994. Calibration casts with CTD/rosette were also made to accomplish the requirements of the sensors being recovered/deployed.

Further stations were made to check the intermediate waters in the passage between Tenerife and La Palma Islands (transect with stations 6 to 12) and two others between El Hierro and La Gomera Islands (13, 14). The idea is to track the presence of the Antarctic Intermediate Water (AAIW). There is a great controversy whether the AAIW will be present in the north of the archipelago due to the circulation through the passages between the different islands, and to which extent.

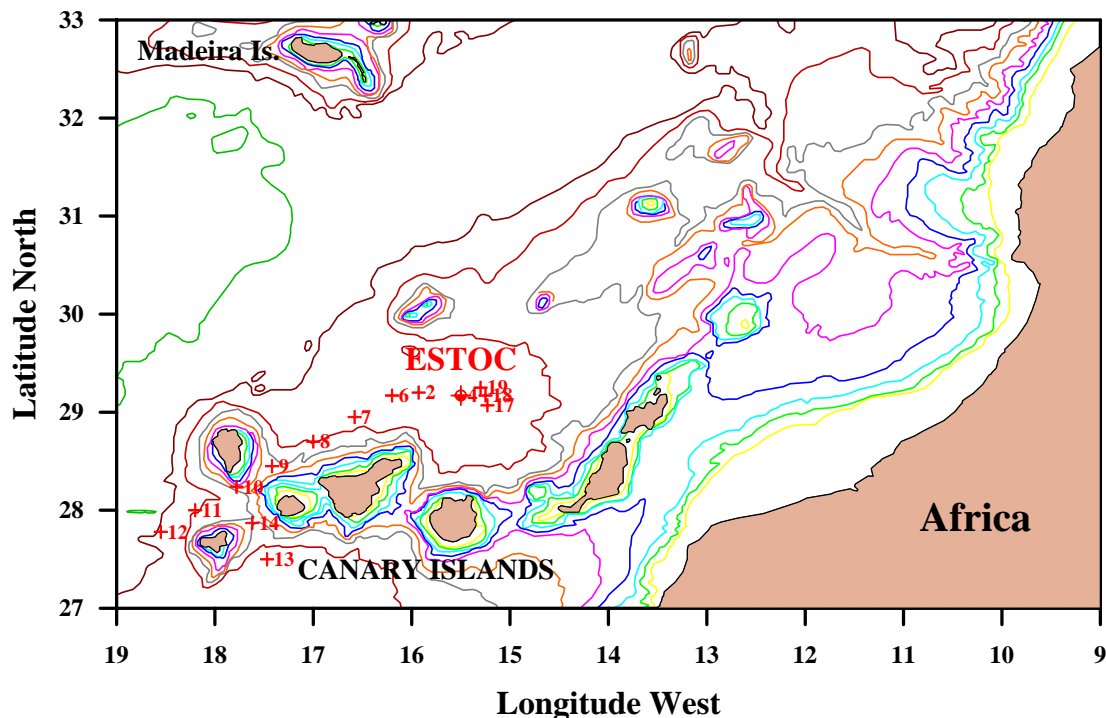


Figure 11: Position of the CTD stations (red crosses) made along Poseidon P320.

At the beginning of the cruise the DOLAN/ANIMATE mooring had to be recovered, hence a rosette/CTD cast to 500 m was made in order to have a calibration of the chemical sensors before their recovery (st. #2). Then, after the DOLAN mooring with the chemical sensors from ANIMATE was recovered, the ESTOC station monthly sampling took place (st. 4, sampled to the bottom). After this, two transects between islands were made (st. 6-12, 13-14, down to 2000 m water depth except stations 6 and 12 that were made to the bottom) and finally a calibration was made prior to the mooring deployment (st. 17, to 500 m) and other stations around ESTOC were investigated to find the ESTOC variability at the proximities (st. 18 and 19, to 2000 m).

The nitrate sensor was exchanged, collecting #2624 and deploying the same one after putting new reagents and changing the battery. Results were not satisfactory because the sensor only worked for some days and there seemed to be a problem in the colorimeter which produced the same result blank and reaction values.

Table 2: List of stations sampled along the cruise P320, Las Palmas-DOLAN-Cape Blanc ANIMATE-DOLAN-Las Palmas (O=oxygen, Su= Susanne Neuer, N=nutrients, S=salinity, C=chlorophyll "a", Ja = Jana Koester, Inc= Incidences) .

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
08.03. 2005	1, 01, 001	3586	28°34.31'	15°34.14'	500			To take water for sediment traps						
						1	500		✓					Open
						2	500		✓					
						3	500		✓					
						4	500		✓					
						5	500		✓					
						6	500		✓					
						7	500		✓					
						8	500		✓					
						9	300		✓					
						10	300		✓					
						11	300		✓					
						12	300		✓					
						13	300		✓					
						14	300		✓					
						15	300		✓					
						16	300		✓					
						17	300		✓					
						18	200		✓					
						19	200		✓					
						20	200		✓					
						21	200		✓					
						22	200		✓					
						23	200		✓					
						24	200		✓					
09.03. 2005 09:41	3, 02, 001	3630	29°12.44'	15°56.96'	500			Test cast by DOLAN mooring, for chemical pack calibration before recovery						
						1	500	✓		✓	✓			
						2	500	✓		✓				
						3	400	✓		✓				
						4	300	✓		✓				
						5	200	✓		✓		✓		
						6	200							
						7	150	✓		✓		✓		
						8	150							
						9	125	✓		✓		✓		
						10	125							
						11	100	✓		✓		✓		
						12	100							
						13	85							Open
						14	85	✓		✓	✓	✓		
						15	70	✓		✓		✓		
						16	70							
						17	55	✓		✓		✓		
						18	55							

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
09.03. 2005 09:41	3, 02, 001	3630	29°12.44'	15°56.96'	500			Test cast by DOLAN mooring, for chemical pack calibration before recovery						
						19	40	√		√		√		
						20	40							
						21	25	√		√		√		
						22	25							
						23	10	√		√	√	√		
						24	10							
10.03. 2005	6, 03, 001	3636	29°16.59'	15°59.06'	200			Cast after recovery Sediment traps						
						1	200		√					
						2	200		√					
						3	150		√					
						4	150		√					
						5	140		√					
						6	140		√					
						7	125		√					
						8	125		√					
						9	100		√					
						10	100		√					
						11	90		√					
						12	90		√					
						13	75		√					
						14	75		√					
						15	60		√					
						16	60		√					
						17	50		√					
						18	50		√					
						19	35		√					
						20	35		√					
						21	25		√					
						22	25		√					
						23	10		√					
						24	10		√					
11.03. 2005	12, 04, 001	3611	29°09.98'	15°29.85'	3612			Station ESTOC March 2005						
								Al+pH (only this station)						
						1	3612	√	√	√	√			√
						2	3500	√	√	√	√			
						3	3000	√	√	√	√			
						4	2800	√	√	√	√			
						5	2500	√	√	√	√			
						6	2000	√	√	√	√			√
						7	1800	√	√	√	√			
						8	1500	√	√	√	√			
						9	1300	√	√	√	√			
						10	1200	√	√	√	√			√
						11	1100	√	√	√	√			
						12	1000	√	√	√	√			
						13	800	√	√	√	√			√
						14	600	√	√	√	√			
						15	400	√	√	√	√			√
						16	300	√	√	√	√			
						17	200	√	√	√	√	√	√	
						18	150	√	√	√	√	√	√	
						19	125	√	√	√	√	√	√	
						20	100	√	√	√	√	√	√	

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
11.03. 2005	12, 04, 001	3611	29°09.98'	15°29.85'	3612			Station ESTOC March 2005						
								Al+pH (only this station)						
						21	75	✓	✓	✓	✓	✓	✓	
						22	50	✓	✓	✓	✓	✓	✓	
						23	25	✓	✓	✓	✓	✓	✓	
						24	10	✓	✓	✓	✓	✓	✓	
11:03. 2005	13, 05, 001	3610	29°10.00'	15°29.82'	1500			ESTOC 03/05, Samples for HPLC						
						1	1500		✓					
						2	1500		✓					
						3	1200		✓					
						4	1200		✓					
						5	1000		✓					
						6	1000		✓					
						7	800		✓					
						8	800		✓					
						9	500		✓					
						10	500		✓					
						11	500		✓					
						12	500		✓					
						13	400		✓					
						14	400		✓					
						15	150		✓					
						16	150		✓					
						17	100		✓					
						18	100		✓					
						19	40		✓					
						20	40		✓					
						21	25		✓					
						22	25		✓					
						23	10		✓					
						24	10		✓					
11:03. 2005	15, 06, 001	3660	29°09.96'	16°12.00'	3671			1 st . station transect TF- LP Islands						
						1	3671							Open
						2	3500	✓		✓	✓			
						3	3000	✓		✓				
						4	2800	✓		✓				
						5	2500	✓		✓				
						6	2000	✓		✓				
						7	1800	✓		✓				
						8	1500	✓		✓				
						9	1300	✓		✓				
						10	1200	✓		✓				
						11	1100	✓		✓				
						12	1000	✓		✓				
						13	800	✓		✓	✓			
						14	600	✓		✓				
						15	400	✓		✓				
						16	300	✓		✓				
						17	200	✓		✓			✓	
						18	150	✓		✓			✓	
						19	125	✓		✓			✓	
						20	100	✓		✓			✓	

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
11:03. 2005	15, 06, 001	3660	29°09.96'	16°12.00'	3671			1 st . station transect TF- LP Islands						
						21	75	√		√		√		
						22	50	√		√		√		
						23	25							Open
						24	10	√		√	√	√		
12:03. 2005	16, 07, 001	3517	28°56.00'	16°35.00'	2000			2 nd station transect TF- LP Islands						
						1	2000	√		√	√		√	
						2	1800	√		√				
						3	1500	√		√				
						4	1300	√		√				
						5	1200	√		√			√	
						6	1100	√		√				
						7	1000	√		√				
						8	900	√		√				
						9	800	√		√			√	
						10	600	√		√				
						11	400	√		√			√	
						12	300	√		√				
						13	200	√		√	√	√	√	
						14	150	√		√		√		
						15	125	√		√		√	√	
						16	100	√		√		√	√	
						17	75	√		√		√	√	
						18	50	√		√		√	√	
						19	10	√		√		√	√	
						20	10							
						21	10							
						22	10							
						23	10	√		√	√	√	√	
						24	10							
12:03. 2005	17, 08, 001	3310	28°42.01'	16°59.77'	2000			3 rd station transect TF- LP Islands						
						1	2000	√		√	√		√	
						2	1800	√		√	√			
						3	1500	√		√	√			
						4	1300	√	√	√	√			
						5	1200	√		√	√		√	
						6	1100	√		√	√			
						7	1000	√		√	√			
						8	900	√		√	√			
						9	800	√		√	√		√	
						10	600	√		√	√			
						11	400	√		√	√		√	
						12	300	√		√	√			
						13	200	√		√	√	√	√	
						14	150	√		√	√	√		
						15	125	√		√	√	√	√	
						16	100	√		√	√	√	√	
						17	75	√		√	√	√	√	
						18	50	√		√	√	√	√	
						19	25	√		√	√	√	√	
						20	10							
						21	10							
						23	10	√		√		√	√	
						24	10							

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
12.03. 2005	18, 09, 001	2848	28°28.00'	17°25.00'	2000			4 th station transect TF- LP Islands						
					1	2000	✓			✓	✓			
					2	1800	✓			✓				
					3	1500	✓			✓				
					4	1300	✓			✓				
					5	1200	✓			✓				
					6	1100	✓			✓				
					7	1000	✓			✓				
					8	900	✓			✓				
					9	800	✓			✓				
					10	600	✓			✓				
					11	400	✓			✓				
					12	300	✓			✓				
					13	200	✓			✓	✓	✓		
					14	150	✓			✓		✓		
					15	125	✓			✓		✓		
					16	100	✓			✓		✓		
					17	75	✓			✓		✓		
					18	50	✓			✓		✓		
					19	25	✓			✓		✓		
					20	10								
					21	10								
					22	10								
					23	10	✓			✓	✓	✓		
					24	10								
12.03. 2005	19, 10, 001	2999	28°15.02'	17°47.06'	2000			5 th station transect TF- LP Islands						
					1	2000	✓			✓	✓		✓	
					✓	1800	✓			✓				
					3	1500	✓			✓				
					4	1300	✓			✓				
					5	1200	✓			✓			✓	
					6	1100	✓			✓				
					7	1000	✓			✓				
					8	900	✓			✓				
					9	800	✓			✓			✓	
					10	600	✓			✓				
					11	400	✓			✓			✓	
					12	300	✓			✓				
					13	200	✓			✓	✓	✓	✓	
					14	150	✓			✓		✓	✓	
					15	125	✓			✓		✓	✓	
					16	100	✓			✓		✓	✓	
					17	75	✓			✓		✓	✓	
					18	50	✓			✓		✓	✓	
					19	25	✓			✓		✓	✓	
					20	10							✓	
					21	10								
					22	10								
					23	10	✓			✓	✓	✓		
					24	10								
13.03. 2005	20, 11, 001	3365	28°00.02'	18°11.97'	2000			6 th station transect TF- LP Islands						
					1	2000	✓			✓	✓		✓	
					2	1800	✓			✓				
					3	1500	✓			✓				
					4	1300	✓			✓				
					5	1200	✓			✓			✓	
					6	1100	✓			✓				

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
13.03. 2005	20, 11, 001	3365	28°00.02'	18°11.97'	2000			6 th station transect TF- LP Islands						
					7		1000	✓		✓				
					8		900	✓		✓				
					9		800	✓		✓			✓	
					10		600	✓		✓				
					11		400	✓		✓			✓	
					12		300	✓		✓				
					13		200	✓		✓	✓	✓	✓	
					14		150	✓		✓		✓	✓	
					15		125	✓		✓		✓	✓	
					16		100	✓		✓		✓	✓	
					17		75	✓		✓		✓	✓	
					18		50	✓		✓		✓	✓	
					19		25	✓		✓		✓	✓	
					20		10							
					21		10							
					22		10							
					23		10	✓		✓	✓	✓		
					24		10						✓	
13.03. 2005	21, 12, 001	3950	27°47.00'	18°33.00'	3870			7 th station transect TF- LP Islands						
					1		3933	✓		✓	✓			
					2		3500	✓		✓				
					3		3000	✓		✓				
					4		2800	✓		✓				
					5		2500	✓		✓				
					6		2000	✓		✓				
					7		1800	✓		✓				
					8		1500	✓		✓				
					9		1300	✓		✓				
					10		1200	✓		✓				
					11		1100	✓		✓				
					12		1000	✓		✓				
					13		800	✓		✓	✓			
					14		600	✓		✓				
					15		400	✓		✓				
					16		300	✓		✓				
					17		200	✓		✓		✓		
					18		150	✓		✓		✓		
					19		125	✓		✓		✓		
					20		100	✓		✓		✓		
					21		75							Open
					22		50	✓		✓		✓		
					23		25	✓		✓	✓	✓		
					24		10	✓		✓		✓		
13.03. 2005	22, 13, 001	3657	27°30.00'	17°28.80'	2000			1 st station transect HI- GO Islands						
					1		3640	✓		✓	✓		✓	
					2		3500	✓		✓				
					3		3000	✓		✓				
					4		2800	✓		✓				
					5		2500	✓		✓				
					6		2000	✓		✓			✓	
					7		1800	✓		✓				
					8		1500	✓		✓				
					9		1300	✓		✓				
					10		1200	✓		✓			✓	
					11		1100							Open
					12		1000	✓		✓				

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
13.03. 2005	22, 13, 001	3657	27°30.00'	17°28.80'	2000		1 st station transect HI- GO Islands							
						13	800	√		√	√		√	
						14	600	√		√				
						15	400	√		√			√	
						16	300	√		√				
						17	200	√		√		√	√	
						18	150	√		√		√		
						19	125	√		√		√	√	
						20	100	√		√		√	√	
						21	75							Open
						22	50	√		√		√	√	
						23	25	√		√	√	√	√	
						24	10	√		√		√	√	
13.03. 2005	23, 14, 001	3186	27°50.00'	17°35.00'	3133		2 nd station transect HI- GO Islands							
						1	3133	√		√	√		√	
						2	3000	√		√				
						3	2800	√		√				
						4	2500	√		√				
						5	2000	√		√			√	
						6	1800	√		√				
						7	1500	√		√				
						8	1300	√		√				
						9	1200	√		√				
						10	1100	√		√			√	
						11	1000	√		√				
						12	900	√		√				
						13	800	√		√	√		√	
						14	600	√		√				
						15	400	√		√			√	
						16	300	√		√				
						17	200	√		√		√	√	
						18	150	√		√		√		
						19	125	√		√		√	√	
						20	100	√		√		√	√	
						21	75	√		√		√		
						22	50	√		√		√	√	
						23	25	√		√	√	√	√	
						24	10	√		√		√	√	
13.03. 2005	24, 15, 001	3342	28°00.03'	18°12.01'	2000		Repetition of 6 th station transect TF- LP Islands, due to a strong current (one knot) to the north when it was sampled							
						1	2000	√		√	√			
						2	1800	√		√				
						3	1500	√		√				
						4	1300	√		√				
						5	1200	√		√				
						6	1100	√		√				
						7	1000	√		√				
						8	900	√		√				
						9	800	√		√				
						10	600	√		√				
						11	400	√		√				
						12	300	√		√				
						13	200	√		√	√	√		
						14	150	√		√		√		
						15	125	√		√		√		
						16	100	√		√		√		

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
13.03. 2005	24, 15, 001	3342	28°00.03'	18°12.01'	2000			Repetition of 6 th station transect TF-LP Islands, due to a strong current (one knot) to the north when it was sampled						
						17	75	√		√		√		
						18	50	√		√		√		
						19	25	√		√		√		
						20	10							
						21	10							
						22	10							
						23	10	√		√	√	√		
						24	10							
15.03. 2005	26, 16, 001	3612	29°10.03'	15°13.01'	2000			To take water for sediment traps						
						1	500		√					
						2	500		√					
						3	500		√					
						4	500		√					
						5	500		√					
						6	500		√					
						7	500		√					
						8	500		√					
						9	300		√					
						10	300		√					
						11	300		√					
						12	300		√					
						13	300		√					
						14	200		√					
						15	200		√					
						16	200		√					
						17	200		√					
						18	200		√					
						19	200		√					
						20	200		√					
						21	60		√					
						22	60		√					
						23	10		√					
						24	10		√					
15.03. 2005 15:40	29, 17, 001	3592	29°03.00'	15°14.00'	500			Test cast for physical / chemical calibration before mooring deployment						
						1	500	√		√	√			
						2	500							
						3	200	√		√	√	√		
						4	150	√		√	√	√		
						5	125	√		√	√	√		
						6	100	√		√	√	√		
						7	100							
						8	90	√		√	√	√		
						9	90							
						10	80	√		√	√	√		
						11	80							
						12	70							
						13	70	√		√	√	√		
						14	50	√		√	√	√		
						15	40	√		√	√	√		
						16	25	√		√	√	√		
						17	10							

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
15.03. 2005 15:40	29, 17, 001	3592	29°03.00'	15°14.00'	500			Test cast for physical / chemical calibration before mooring deployment						
						18	10	√		√	√	√		
						19								
						20								
						21								
						22	microCats and fluorometer in place of Niskin bottles							
						23								
						24								
15.03. 2005	30, 18, 001	3592	29°10.00'	15°15.00'	3602			Studies around ESTOC: East						
						1	3602	√		√	√			
						2	3500	√		√				
						3	3000	√		√				
						4	2800	√		√				
						5	2500	√		√				
						6	2000	√		√				
						7	1800	√		√				
						8	1500	√		√				
						9	1300	√		√				
						10	1200	√		√				
						11	1100	√		√				
						12	1000	√		√				
						13	800	√		√	√			
						14	600	√		√				
						15	400	√		√				
						16	300	√		√				
						17	200	√		√			√	
						18	150	√		√			√	
						19	125	√		√			√	
						20	100	√		√			√	
						21	75	√		√				
						22	50	√		√			√	
						23	25	√		√	√		√	
						24	10	√		√			√	
15.03. 2005	31, 19, 001	3592	29°10.00'	15°15.00'	3602			Studies around ESTOC: North						
						1	3605	√		√	√			
						2	3500	√		√				
						3	3000	√		√				
						4	2800	√		√				
						5	2500	√		√				
						6	2000	√		√				
						7	1800	√		√				
						8	1500	√		√				
						9	1300	√		√				
						10	1200	√		√				
						11	1100	√		√				
						12	1000	√		√				
						13	800	√		√	√			
						14	600	√		√				
						15	400	√		√				
						16	300	√		√				
						17	200	√		√			√	
						18	150	√		√			√	
						19	125	√		√			√	
						20	100	√		√			√	
						21	75	√		√			√	
						22	50	√		√			√	

Table 2: continued

Date Time (hh:mm)	St. #, CTD, Cast	water depth (m)	Lat. N	Long. W	Depth (m)	Nisk bot	depth sam.	Parameters						
								O	Su	N	S	C	Ja	Inc
15.03. 2005	31, 19, 001	3592	29°10.00'	15°15.00'	3602			Studies around ESTOC: North						
						23	25	√		√	√	√		
						24	10	√		√		√		
10.03. 2005	35, 20, 001	3608	29°54.00'	15°11.06'	200			Cast after recovery Sediment traps						
						1	200		√					
						2	200		√					
						3	150		√					
						4	150		√					
						5	125		√					
						6	125		√					
						7	100		√					
						8	100		√					
						9	90		√					
						10	90		√					
						11	80		√					
						12	80		√					
						13	70		√					
						14	70		√					
						15	60		√					
						16	60		√					
						17	50		√					
						18	50		√					
						19	25		√					
						20	25		√					
						21	10		√					
						22	10		√					
						23	10		√					
						24	10		√					

Physical (CTD, salinity) and biochemical (oxygen, nutrients, chlorophyll) parameters were measured in order to characterize the water masses present in the water column (Table 2). Some of the parameters (oxygen, chlorophyll filtration) were analysed on board after sampling, and others were taken frozen to the ICCM (nutrients and filters from chlorophyll).

4.3.1 Water Sampling and Analysis

Samples from each depth were collected immediately after the Niskin bottles were on board. The sampling sequence was as follows:

Oxygen

Oxygen was taken in glass bottles of about 125 ml of volume which were previously cleaned and washed with HCl acid and was fixed at once; then it was kept for at least six hours according to WOCE regulations and finally it was analysed at the laboratory on board R/V POSEIDON. The samples were analysed using the method described in the WOCE Operations Manual, WHP Office Report No. 68/91; the final titration point was detected using a Metrohm 665 Dosimat Oxygen Auto-Titrator Analyser.

Nutrients

Nutrients were taken in polypropylene bottles which were previously cleaned and washed with HCl acid and were completely dry. Samples were immediately frozen at -20°C, analysing them as soon as possible after arrival at the laboratory. Freezing the samples is a common practice; it does not or only in a non-significant way affects the nitrate+nitrite and the phosphate values (by a slight decrease) and is not noticeable in the silicate values (Kremling and Wenck, 1986; McDonald and McLunghlin, 1982).

The nutrients determination was performed with a segmented continuous-flow autoanalyser, a Skalar® San Plus System (ICCM).

Nitrate and Nitrite

The automated procedure for the determination of nitrate and nitrite is based on the cadmium reduction method; the sample is passed through a column containing granulated copper-cadmium to reduce the nitrate to nitrite (Wood et al., 1967), using ammonium chloride as pH controller and complexer of the cadmium cations formed (Strickland and Parsons, 1972). The optimal column preparation conditions are described by several authors (Nydahl, 1976; Garside, 1993).

Phosphate

Orthophosphate concentration is understood as the concentration of reactive phosphate (Riley and Skirpow, 1975) and according to Koroleff (1983a) is a synonym of “dissolved inorganic phosphate”. The automated procedure for the determination of phosphate is based on the following reaction: ammonium molybdate and potassium antimony tartrate react in an acidic medium with diluted solution of phosphate to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-coloured complex, ascorbic acid. The complex is measured at 880 nm. The basic methodology for this anion determination is given by Murphy and Riley (1962); the used methodology is the one adapted by Strickland and Parsons (1972).

Silicate

The determination of the soluble silicon compounds in natural waters is based on the formation of the yellow coloured silicomolybdic acid; the sample is acidified and mixed with an ammonium molybdate solution forming molybdosilicic acid. This acid is reduced with ascorbic acid to a blue dye, which is measured at 810 nm. Oxalic acid is added to avoid phosphate interference. The used method is described in Koroleff (1983b).

Phytoplankton pigments

Pigments were measured using fluorimetric analysis, following the methodology described by Welschmeyer (1994). The determination was achieved using a fluorometer TURNER 10-AU-000.

Salinity

Salinity samples were taken in dark glass bottles which were previously cleaned and washed with HCl acid. Then, they were kept in boxes to protect them from light till analysis on land. Samples were measured with a salinometer, model Autosal 8400a, whose measurement range was between 0.005-42 (psu), with an accuracy of ± 0.003 , according to the manufacturer. It was calibrated following the manufacturer's information and standarizing it with IAPSO Standard Seawater. Salinity values were calculated as practical salinity according to Unesco (1978, 1984).

Chlorophyll

Chlorophyll samples of one liter of water were taken. The chlorophyll samples were filtered immediatelly and the filters were frozen subsequently at -20°C . Their analyses take place at the ICCM laboratory on land.

All samples were taken using the procedures established in the WOCE Operations Manual, WHP Office Report WHPO 91-1/WOCE Report No.68/91.

4.3.2 Preliminary Results

This cruise took place during early spring, which corresponds in surface waters and for this area, to the time of the year when the mixed layer of about 125-150 m water depth, that was formed during the late Winter disappears, and it starts the seasonal thermocline formation.

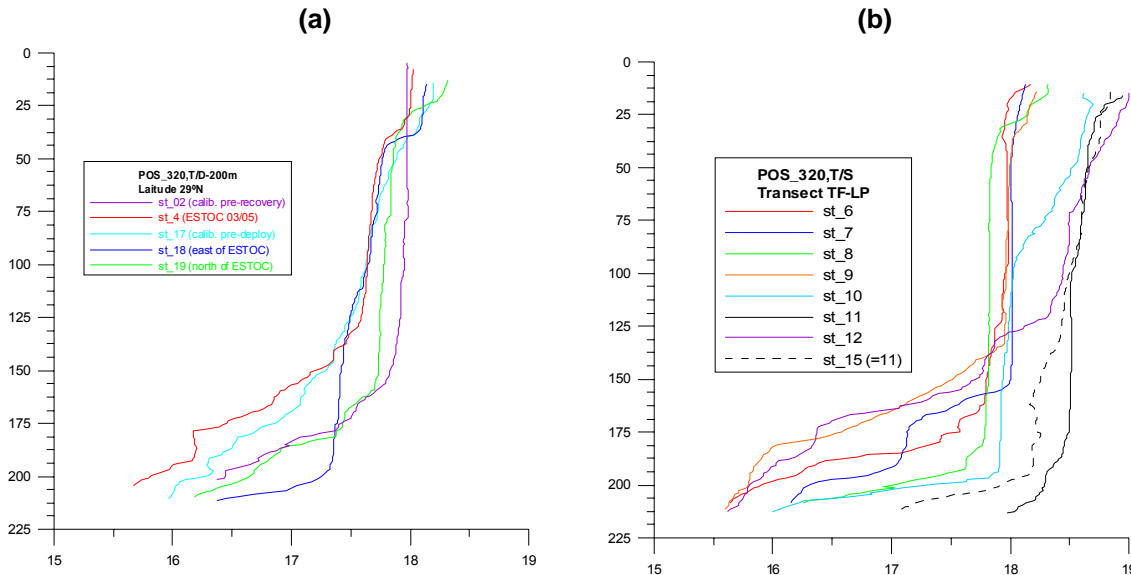


Figure 12: Potential temperature (°C, abscise) versus depth (m, ordinate) for the latitudinal area where ESTOC is located (a) and the transect between Tenerife and La Palma Islands (b). Both plots show only the upper layer, around 200m deep.

Looking at the T/S plots (Figure 12) from the upper 200 m it is obvious that in some areas this fact takes place before on time than in the others. Even the same station just one day later (stations 11 and 15 were made at the same site with one day of difference) shows this change from a homogeneous layer in station 11 ($T = 17.5 - 18.5^{\circ}\text{C}$) to a sloped profile in station 15, backed by an XBT deployed 2 miles from the same station (Figure 12b).

The subsurface waters encountered below the mixed layer represent the temperature and salinity values that characterise the NACW (North Atlantic Central Water) straight line. The range of values are $12 - 17.5^{\circ}\text{C}$ and $35.6 - 36.6$ for temperature and salinity respectively and correspond adequately for the area.

Several stations were made in the passages between La Palma and Tenerife Islands and La Gomera and El Hierro islands to study the possible appearance of intermediate waters (800-1200 m depth) as mentioned in the literature. Both at 29°N and within the transects, we find at intermediate levels all the range expected at these depths (35.2 to 35.6 of salinity and 5 to 12°C of temperature), as a consequence of the north-south variability inherent to the area (Figure 14a, b and c).

Nevertheless and within the fringe of the intermediate waters encountered during the cruise (about $7 - 11^{\circ}\text{C}$ of temperature), all the salinity values encountered are below 35.5 units, corresponding to the limit of the Mediterranean Water presence for this area (see example in Llinás et al., 2003). However, at these depths it also appears the Antarctic Intermediate Water (AAIW) and by looking at Figure 14 it is obvious that there is a gradient from north to south of the presence of MW and/or AAIW (salinity ranges from 35.25 to 35.5).

To the north and east the presence of MW with higher salinity and temperature is more notorious (st. 6-8, 18-19) and in the southern most the T/S values show AAIW characteristics with lower salinity and temperature values (st. 10-14, 19); stations 9 and 10 show the mixing characteristics between both water masses. The oxygen measured at the same stations corroborates this fact (Figure 14), having lower relative values for each station

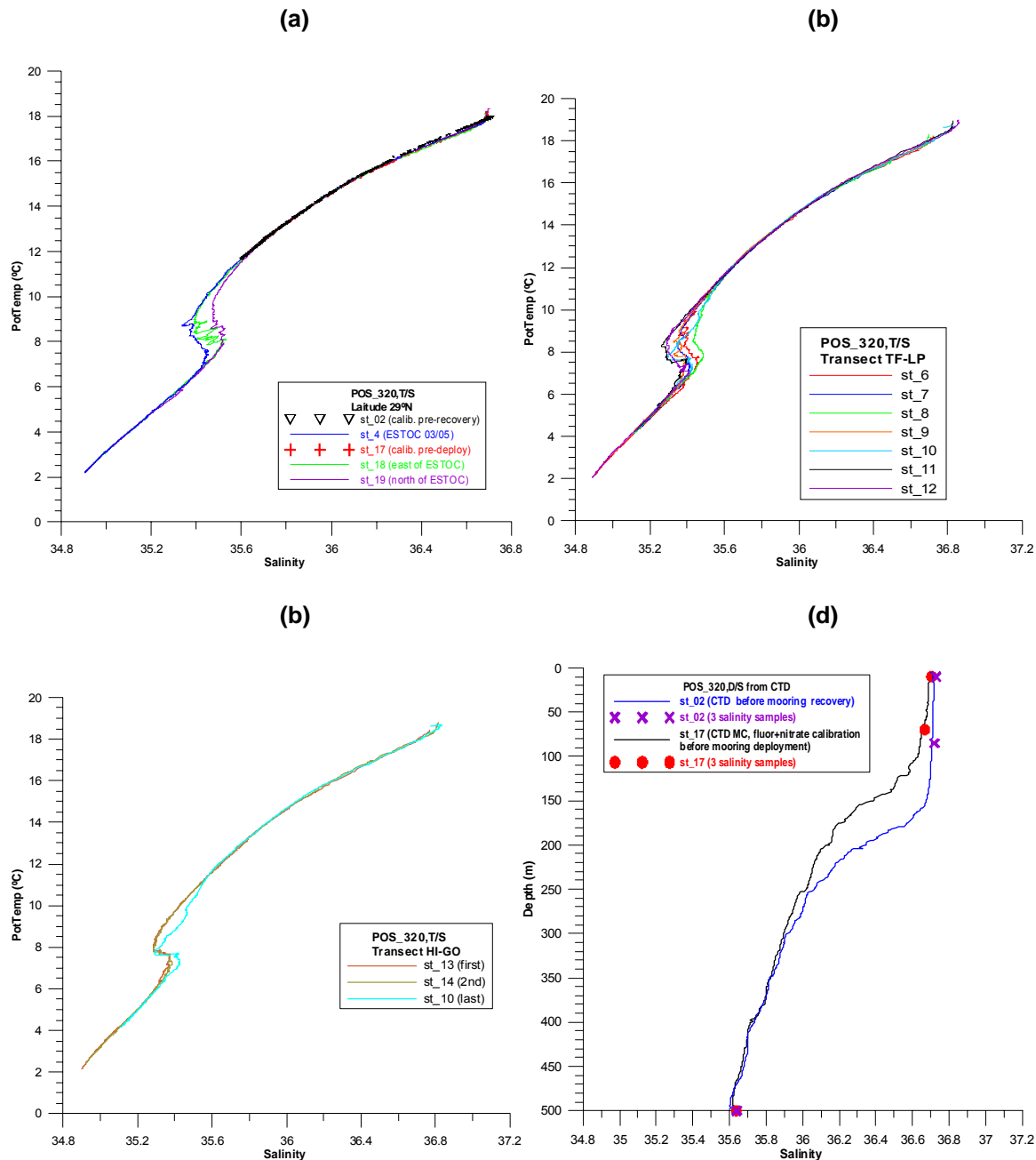


Figure 13: Temp./Sal. Plots (a) from the 29°N area, including the stations made to calibrate the sensors in the ESTOC mooring. (b) The transect made between Tenerife and La Palma Islands, and (c) the stations corresponding to the transect between El Hierro and La Gomera Islands. Down to the right (d), the correspondence between the CTD and the salinity samples for the two sensor calibration stations in order to check the correct Niskin bottles closures.

(around 3.1 ml/l) the bigger the amount of Antarctic Intermediate Water. To the north the oxygen minima relative values are of the order of 3.35 ml/l which are related to the MW

presence. The minima ranges from 3.35 (st. 4, ESTOC) to 3.6 ml/l (st. 19, north of ESTOC) in the north, and between 3.1 (st. 14) and 3.5 (st. 10) in the south.

This complex mixing process in these water masses is also due to the effect produced by the channels between the islands, which induces a bulking effect when the same amount of water enters into these narrower passages.

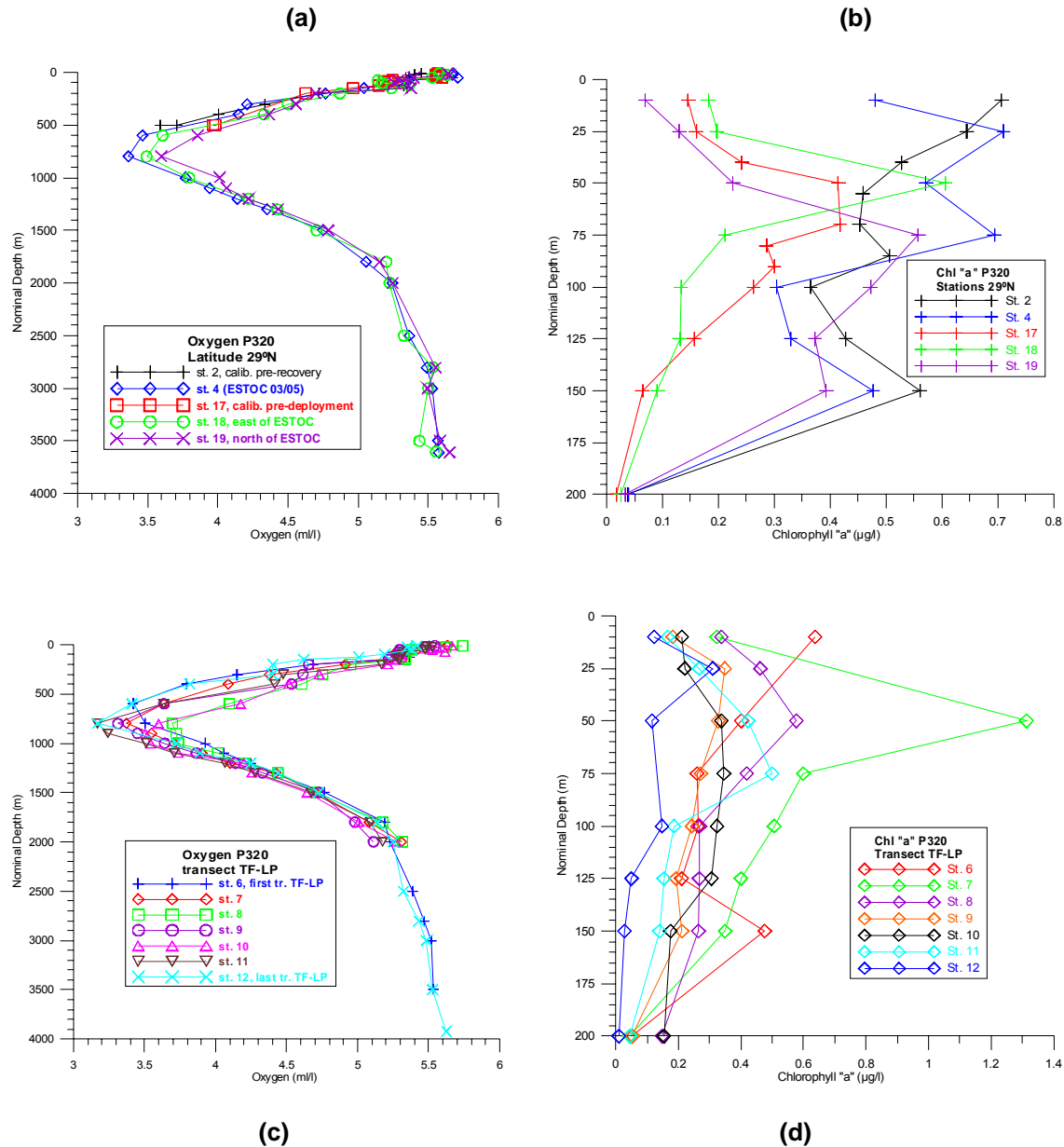


Figure 14: Oxygen (4000m depth) and chlorophyll „a“(200m) in the stations made at latitude 29°N including the ESTOC station (a,b) and in the transect between Tenerife and La Palma Islands (c,d).

The chlorophyll „a“ is plotted in Figure 14b and 14d for the 29°N area and the transect TF-LP respectively. Values ranged between 0 and 0.7 µg/l at latitude 29°N and between 0 and 0.5 µg/l except for station 7, which shows a maxima of 1.3 µg/l at 50 m depth. The variability found for the maxima at each station is related to the thermocline formation effects already mentioned. The mixed layer is losing its homogeneity along the cruise days, and if there are

inputs of nutrients from below, the amount of phytoplankton increases producing greater fluorescence values at different depths.

Lastly, a remark concerning the measurement of the chemical parameters by the sensors within the CTD/ rosette. The CTD and fluorometer had been calibrated before going on board but it seems they loose their calibration very rapidly for the non-physical variables.

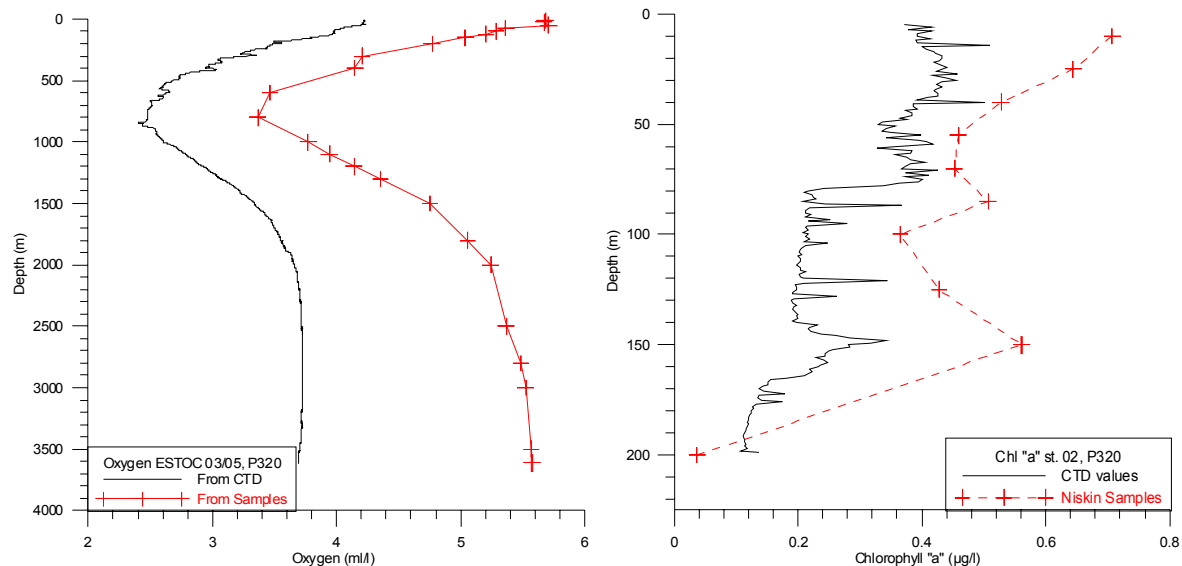


Figure 15: Variation of CTD sensors for oxygen and chlorophyll "a" with respect to the "in situ" data samples collected from Niskin bottles in rosette.

The CTD measured adequately the physical parameters by comparison to the "in situ" data sampled from the Niskin bottles (e.g, salinity in Figure 13d), and both the oxygen sensor and the fluorometer were able to produce an adequate shape for the chemical parameters. Figure 15 shows the oxygen and chlorophyll "a" measured at ESTOC by the sensors installed with the CTD, and the values obtained from the laboratory analyses of the data taken with the rosette. It is obvious that both measurements complement each other, since the data obtained by sampling the Niskin bottles permit to calibrate the sensors; and the sensors provide a finer description of the phenomena that the discrete data cannot always capture.

4.3.3 Stable Nitrogen and Carbon Isotopes of Marine Particles

4.3.3.1 Introduction

The origin of organic matter may be characterized by its chemical composition. Especially the stable nitrogen isotopes allow valuable insights into the production and degradation history of organic particles. Low values of the stable nitrogen isotope ratio $\delta^{15}\text{N}$ and high concentration of organic nitrogen and carbon are expected of material generated in an upwelling system. Higher $\delta^{15}\text{N}$ values, on the other hand, are typical of organic matter produced in oligotrophic systems. In addition, degradation of organic matter causes an enrichment of $\delta^{15}\text{N}$. In this study, the stable nitrogen isotope ratio as well as the carbon isotope ratio of particulate (mainly suspended) material will be determined and compared to the organic chemistry of fast sinking material sampled by particle traps. To get a better compendium of the isotopic composition of the different water masses influencing the particle trap sample isotope compositions, sea surface samples were also taken for nitrogen and carbon isotope measurements.

4.3.3.2 Methods

Vertical profiles (Rosette)

Water from selected depths, reaching from 10 m water depth to near the sea floor, was sampled on certain rosette stations for analysis of $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ of particulate material. For stations see table 2 (marked with “Ja”).

For the rosette samples 5 l of seawater from each depth and site were filtrated onto precombusted GGF-filters. The filters were dried at 60°C to inhibit chemical and biological reactions, which could have an influence on the isotope ratios. $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ will be measured using a Finnigan mass spectrometer. For the analysis the filters will be divided into halves, for one decalcified and one non decalcified series of measurements.

4.3.3.3 First Results

Vertical profiles (rosette)

Assuming that the colour of the filters is an indicator of the particle concentration, first results can be seen based solely on the optical impression of the filters. As observable in the volumes at some stations it was impossible to filtrate 5 l of seawater at each depth, due to the fact that the filters get plugged after a few litres. The particle concentration was highest in depths between 50 m and 200 m at each station.

Additional information will be expected by comparison of salinity and temperature data from the sea surface, and from each depth of CTD measurements (Tab. 2).

4.3.4 Drifting particle traps and water column sampling

The drifting trap experiments were carried out both in the DOLAN and ESTOC area to determine particulate flux in short time intervals and directly from underneath the winter mixed layer. The surface-tethered particle interceptor arrays carried traps at 200 m, 300 m and 500 m depths. The traps were attached to a surface buoy carrying an ARGOS transmitter, flash and a Radar reflector. The main buoyancy was located at about 30 m depth to avoid the wind-induced EKMAN layer (Figure 17).

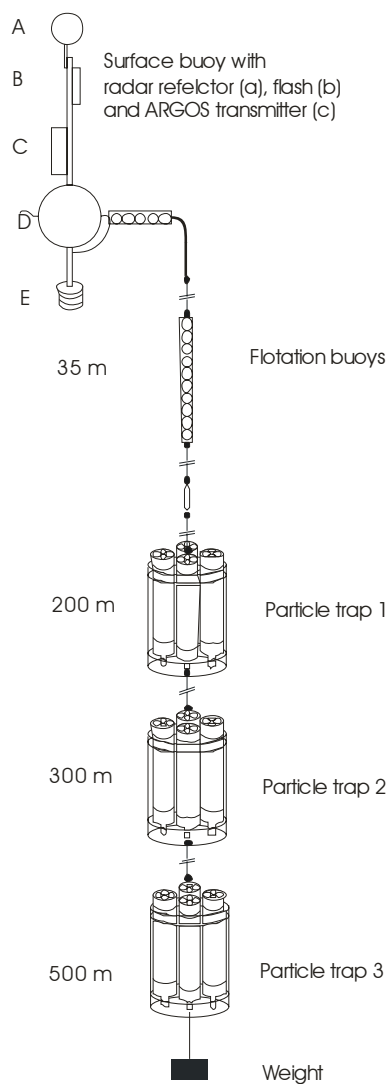
Each trap carried 4 sample bottles. The bottles were filled with 0.2 μm filtered seawater, with NaCl added to achieve a salinity of 40 psu. Three of the cups were fixed with 2% formalin, the fourth cup was reserved for the molecular analysis of the trap material and did not contain any fixative. After recovery those samples were filtered onto GF/F and frozen in liquid nitrogen. From the remaining cups, particulate material will be analysed for dry weight, particulate organic carbon, nitrogen and phosphorus content after return to shore.

During POSEIDON cruise 320, two deployments were carried out, one in the DOLAN area and the second one around ESTOC. Trap III-1 drifted in north westerly direction, trap III-2 in south easterly direction, both with a speed of approximately 10 cm/s (Table 3, Figure 17 A). III-1 was deployed in the DOLAN area, III-2 was deployed at ESTOC.

Table 3: Deployment data, distance drifted and drift speed of the surface-tethered traps.

Drifter	Deployment period	Deployment Position N, W	Recovery Position N, W	Time Deployed, h	Distance, km	Speed, cm/s
III-1	9 -10 March	29°12.31'N 015°56.31'W'	29°16.5'N 015°59.1'W	26	8.98	9.6
III-2	15-17 March	29°04.03'N 015°14.94'W	28°54.83' 015°11.84'	51	17.78	9.7

Water samples were taken in the upper 200 m before and after deployment of the traps (see table 2) with the purpose of quantifying and characterizing the standing stock of phytoplankton and microzooplankton. Samples were taken for chlorophyll, flow cytometry, molecular characterization of the community, inverted and epifluorescence microscopy. With the exception of the microscopy samples, all samples were immediately frozen in liquid nitrogen.

**Figure 16:**

Particle trap drifter carrying three traps at 200m, 300m and 500m.

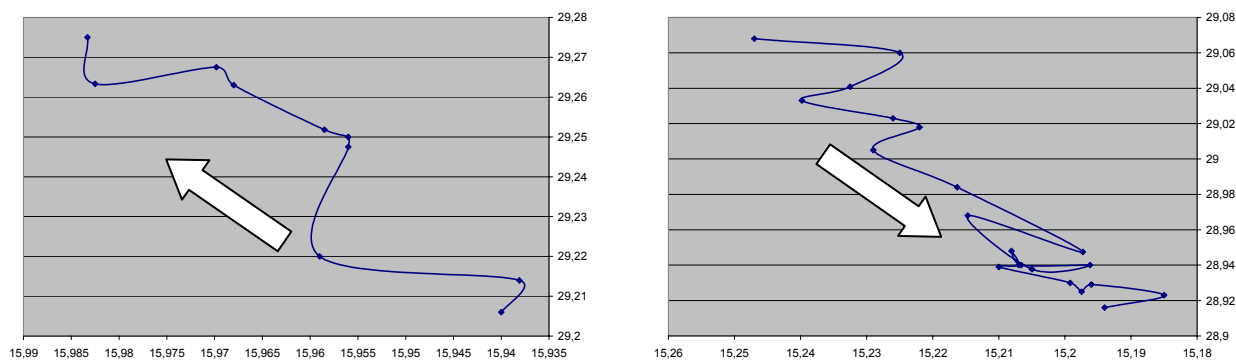


Figure 17: A. Drift course of Trap III-1, B. drift course of Trap III-2. Data from location data transmitted by ARGOS, USA, to the ship via e-mail. Only data were plotted which had a minimum of 4 replicate location data. Arrow indicates drift direction.

The same sampling regime was also carried out at ESTOC stations 12 and 13, in addition to samples for POM (particulate organic matter) and DOM (dissolved organic matter) which were sampled in the entire water column.

6. List of Stations

GeoB-No.	Date 2004	Description	LAT	LONG	WD [m]	Remarks
<i>Commence of scientific research program</i>						
1	08.03.	rosette / CTD	28°34,3 N	015°34,1 W	3567	
2	09.03.	drifter trap no. 3	29°12,40 N	015°56,35 W	3630	deployment drifter
		drifter trap no. 2	29°12,36 N	015°56,35 W	3630	
		drifter trap no. 1	29°12,34 N	015°56,31 W	3630	
		8 benthos	29°12,34 N	015°56,31 W	3630	
		5 benthos	29°12,32 N	015°56,31 W	3630	
		top buoy	29°12,31 N	015°56,31 W	3630	
3	09.03.	rosette / CTD	29°12,44 N	015°55,96 W	3630	
4	09.03.	SAMI	29°11,66 N	015°55,78 W	3630	recovery DOLAN
		transducer	29°11,69 N	015°55,79 W	3630	
		HobiLabs	29°11,56 N	015°56,56 W	3631	
		ADCP+ F 45	29°11,73 N	015°56,09 W	3631	
		SBU	29°11,56 N	015°55,59 W	3632	
		10 benthos	29°11,83 N	015°56,8 W	3632	
		2 benthos	29°11,73 N	015°57,02 W	3634	
		6 benthos	29°11,82 N	015°57,52 W	3633	
		frame DOBS	29°11,82 N	015°57,52 W	3633	
		6 benthos	29°11,89 N	015°57,77 W	3633	
		releaser	29°11,89 N	015°57,77 W	3633	
5	10.03.	10 benthos	29°11,7 N	015°50,1 W	3625	recovery MSD-4
		MSD trap	29°11,8 N	015°50,3 W	3625	
		6 benthos	29°12,1 N	015°50,4 W	3625	
		releaser	29°12,1 N	015°50,4 W	3625	
6	10.03.	top buoy	29°16,5 N	015°59,1 W	3636	recovery drifter
		5 benthos	29°16,5 N	015°59,1 W	3636	
		8 benthos	29°16,5 N	015°59,1 W	3635	
		trap # 1	29°16,7 N	015°59,3 W	3636	
		trap # 2	29°16,7 N	015°59,3 W	3637	
		trap # 3	29°16,8 N	015°59,4 W	3636	
7	10.03.	rosette / CTD	29°16,6 N	015°59,15 W	3636	
8	10.03.	10 benthos	29°10,83 N	015°49,79 W	3626	deployment MSD-5
		MSD sediment trap	29°10,85 N	015°49,83 W	3627	
		2 benthos	29°11,79 N	015°50,11 W	3627	
		2 benthos	29°12,3 N	015°50,6 W	3628	
		6 benthos	29°13,1 N	015°50,8 W	3628	
		releaser	29°13,0 N	015°50,9 W	3628	
		anchor weight	29°13,1 N	015°51,0 W	3628	
9	10.03.	XBT	29°10,1 N	015°31,8 W	3609	

GeoB-No.	Date 2004	Description	LAT		LONG		WD [m]	Remarks
10	10.03.	rosette / CTD	29°09,99	N	015°29,87	W	3608	hydraulic problems
		station suspended	29°10,41	N	015°29,89	W	3608	
		station aborted	29°11,63	N	015°29,39	W	3609	
11	11.03.	top buoy	29°04,30	N	015°15,20	W	3589	recovery CI-17
		10 benthos	29°04,30	N	015°15,20	W	3589	
		sediment trap	29°04,32	N	015°15,21	W	3588	
		6 benthos	29°04,37	N	015°15,25	W	3589	
		sediment trap	29°04,37	N	015°15,25	W	3589	
		6 benthos	29°04,66	N	015°15,32	W	3684	
		sediment trap	29°04,66	N	015°15,32	W	3684	
		6 benthos	29°07,75	N	015°15,26	W	3589	
		releaser	29°07,75	N	015°15,26	W	3589	
12	11.03.	rosette / CTD	29°09,9	N	015°29,9	W	3610	
13	11.03.	rosette / CTD	29°10,0	N	015°30,0	W	3611	
14	11.03.	NOAA drifter	29°09,07	N	015°30,76	W	3611	deployment drifter
15	11.03.	rosette / CTD	29°10,0	N	016°12,0	W	3657	
16	12.03.	rosette / CTD	28°55,99	N	016°34,95	W	3531	
17	12.03.	rosette / CTD	28°42,60	N	016°59,72	W	3309	
18	12.03.	rosette / CTD	28°28,03	N	017°24,97	W	2828	
19	12.03.	rosette / CTD	28°14,94	N	017°46,96	W	3000	
20	13.03.	rosette / CTD	28°00,09	N	018°12,00	W	3356	
21	13.03.	rosette / CTD	27°47,17	N	018°33,10	W	3923	
22	13.03.	rosette / CTD	27°30,06	N	017°28,03	W	3654	
23	13.03.	rosette / CTD	27°51,95	N	017°37,10	W	3185	
24	14.03.	XBT	27°59,50	N	018°09,70	W	3293	
25	14.03.	rosette / CTD	28°00,09	N	018°11,90	W	3351	
26	15.03.	rosette / CTD	29°04,09	N	015°15,21	W	3591	
27	15.03.	top buoy	29°03,52	N	015°17,35	W	3592	deployment CI-18
		10 benthos	29°03,49	N	015°17,31	W	3592	
		sediment trap	29°03,47	N	015°17,26	W	3592	
		6 benthos	29°03,51	N	015°16,88	W	3591	
		sediment trap	29°03,53	N	015°16,82	W	3591	
		6 benthos	29°04,10	N	015°15,18	W	3590	
		sediment trap	29°04,11	N	015°15,15	W	3590	
		6 benthos	29°04,22	N	015°14,86	W	3590	
		releaser	29°04,27	N	015°14,72	W	3589	
		anchor weight	29°04,30	N	015°14,61	W	3589	
28	15.03.	drifter trap no. 3	29°04,14	N	015°15,28	W	3591	deployment drifter traps
		drifter trap no. 2	29°04,14	N	015°15,22	W	3590	
		drifter trap no. 1	29°04,11	N	015°15,12	W	3591	
		8 benthos	29°04,09	N	015°15,03	W	3590	

[illegible]

6. Acknowledgement

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